Ion-Paired Amphiphiles
(Final Report)

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Statement of The Problem

Amphiphilic ion pairs, derived from single-chain cations and single-chain anions (i.e., *ion-paired amphiphiles*, IPA's) were previously introduced as novel vesicle-forming materials. The primary objective of this program has been to define the scope of such IPA's, *via* a careful examination of molecular structure--supramolecular structure/property relationships. Related studies were aimed at exploring the feasibility of creating polymerized vesicles from IPA's. A secondary objective of this program is to examine the feasibility of using IPA-based vesicles as *sensors* for ionic species present in soluton, and as *actuators* for triggering the disruption of conventional double-chain surfactant vesicles. The ultimate goal of this program was to expand IPA chemistry for both theoretical investigations and for applied research.

Summary of The Most Important Results

Work that was carried out under this program demonstrated that a wide variety of amphiphilic ion pairs can function as novel membrane-forming materials. In a broad sense, this work has significantly expanded the scope of synthetic surfactants for use in the membrane area. The demonstration that ionically-paired single chain surfactants can produce bilayer structures is particularly significant because it bridges the gap between single- and double-chain amphiphiles in terms of molecular structure-aggregation activity relationships. In addition, the finding that counterions can play a major role in defining the permeability of surfactant bilayers highlights the fact that there is considerably more room for fine-tuning the barrier properties of resulting membranes than had previously been realized.

Publications

All of the work that has been carried out during the course of this project have been published:

1) Y. Chung, S. L. Regen, *Macromolecules*, *24*, 5738 (1991)

2) K. Hirano, H. Fukuda, S. L. Regen, *Langmuir*, *7*, 1045 (1991).

3) Y. Chung, H. Fukuda, K. Hirano, S. L. Regen, *Langmuir*, *8*, 2842 (1992).

4) Y. Chung, S. L. Regen, *Langmuir*, *9*, 1937 (1993).

5) S. Watanabe, S. L. Regen, *J. Am. Chem. Soc.*, *116*, 5762 (1994).

6) S. Watanabe, S. L. Regen, *J. Am. Chem. Soc.*, *116*, 8855 (1994).

Participating Scientific Personnel

1) S. L. Regen (principal investigator)

2) Dr. Yong Chung (postdoctoral fellow)

3) Dr. Shinji Watanabe (postdoctoral fellow)

Inventions

none

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Work that was carried out under this program demonstrated that a wide variety of amphiphilic ion pairs (i.e., ion-paired amphiphiles, IPA's) can function as novel membrane-forming materials. In a broad sense, this work has significantly expanded the scope of synthetic surfactants for use in the membrane area. The demonstration that ionically-paired single chain surfactants can produce bilayer structures is particularly significant because it bridges the gap between single- and double-chain amphiphiles in terms of molecular structure-aggregation activity relationships. In addition, the finding that counterions can play a major role in defining the permeability of surfactant bilayers highlights the fact that there is considerably more room for fine-tuning the barrier properties of resulting membranes than had previously been realized.

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